United Nations ECE/TRANS/WP.29/2018/22

Economic and Social Council

Distr.: General
3 January 2018

Original: English

Economic Commission for Europe

Inland Transport Committee

World Forum for Harmonization of Vehicle Regulations

174th session
Geneva, 13-16 March 2018
Item 4.8.8 of the provisional agenda
1958 Agreement:
Consideration of draft amendments
to existing UN Regulations submitted by GRSG

Proposal for the 03 series of amendments to UN Regulation No. 110 (CNG and LNG vehicles)

Submitted by the Working Party on General Safety Provisions*

The text reproduced below was adopted by the Working Party on General Safety Provisions (GRSG) at its 113th session (ECE/TRANS/WP.29/GRSG/92, para. 38). It is based on official document ECE/TRANS/WP.29/GRSG/2017/31 as reproduced in Annex IV to the report. It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and to the Administrative Committee AC.1 for consideration at their March 2018 sessions.

* In accordance with the programme of work of the Inland Transport Committee for 2016–2017 (ECE/TRANS/254, para. 159 and ECE/TRANS/2016/28/Add.1, cluster 3.1), the World Forum will develop, harmonize and update UN regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

GE.18-00072(E)

1800072

Please recycle

03 series of amendments to UN Regulation No. 110 (CNG and LNG vehicles)

Table of contents, Annexe 3A, remove the entry for Appendix H.

Paragraph 2. (References), amend to read:

"2. References

The following standards contain provisions that, through reference in this text, constitute provisions of this Regulation.

ASTM Standards[1]	
ASTM B117-90	Test method of Salt Spray (Fog) Testing
ASTM B154-92	Mercurous Nitrate Test for Copper and Copper Alloys
ASTM D522-92	Mandrel Bend Test of attached Organic Coatings
ASTM D1308-87	Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D2344-84	Test Method for Apparent interlaminar Shear Strength of Parallel Fibre Composites by Short Beam Method
ASTM D2794-92	Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D3170-87	Chipping Resistance of Coatings
ASTM D3418-83	Test Method for Transition Temperatures Polymers by Thermal Analysis
ASTM D4814-17	Standard Specification for Automotive Spark-Ignition Engine Fuel
ASTM E647-93	Standard Test, Method for Measurement of Fatigue Crack Growth Rates
ASTM E813-89	Test Method for J_{IC}, a Measure of Fracture Toughness
ASTM G154-16	Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
BSI Standards[2]	
BS 5045	Part 1 (1982) Transportable Gas Containers – Specification for Seamless Steel Gas Containers Above 0.5 litre Water Capacity
BS 7448-91	Fracture Mechanics Toughness Tests Part 1 – Method for Determination of K_{IC}, Critical COD and Critical J Values of BS PD 6493-1991.

[1] American Society for Testing and Materials.
[2] British Standards Institution.

	Guidance an Methods for Assessing the A Acceptability of Flaws in Fusion Welded Structures; Metallic Materials
EN Standards[3]	
EN1251-2 2000	Cryogenic vessels. Vacuum insulated vessels of not more than 1,000 litres volume
EN 895:1995	Destructive tests on welds in metallic materials. Transverse tensile test
EN 910:1996	Destructive test methods on welds in metallic materials. Bend tests
EN 1435:1997	Non-destructive examination of welds. Radiographic examination of welded joints
EN 6892-1:2016	Metallic materials. Tensile test
EN 10045-1:1990	Charpy impact test on metallic materials. Test method (V- and U-notches)
ISO Standards[4]	
ISO 37:2011	Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties.
ISO 148-1983	Steel – Charpy Impact Test (v-notch)
ISO 188:2011	Rubber, volcanized or thermoplastic – Accelerated ageing and heat resistance tests
ISO 306:2004	Plastics - Thermoplastic Materials – Determination of Vicat Softening Temperature
ISO 527-2:2012	Plastics – Determination of tensile properties – Part 2: Test conditions for moulding and extrusion plastics
ISO 642:1999	Steel-Hardenability Test by End Quenching (Jominy Test)
ISO1307:2006	Rubber and plastics hoses – Hose sizes, minimum and maximum inside diameters, and tolerances on cut-to-length hoses
ISO 1402:2009	Rubber and plastics hoses and hose assemblies – Hydrostatic testing
ISO 1431:2009	Rubber, vulcanized or thermoplastic – Resistance to ozone cracking
ISO 1436:2009	Rubber hoses and hose assemblies – Wire-braid-reinforced hydraulic types for oil-based or water-based fluids – Specification
ISO 1817:2015	Rubber, vulcanized or thermoplastic – Determination of the effect of liquids

[3] European Norm.
[4] International Organization for Standardization.

ISO 2808:2007	Paints and Varnishes – Determination of film Thickness
ISO 4080:2009	Rubber and plastics hoses and hose assemblies – Determination of permeability to gas
ISO 4624:2016	Plastics and Varnishes – Pull-off Test for adhesion
ISO 10619:2011	Rubber and plastics hoses and tubing - Measurement of flexibility and stiffness - Part 2: Bending tests at sub-ambient temperatures
ISO 6892:2016	Metallic Materials – Tensile Testing
ISO 6506-1:2014	Metallic Materials – Brinell hardness test – Part 1: Test method
ISO 6508-1:2015	Metallic Materials – Rockwell hardness Test – Part 1: Test method
ISO 7225:2005	Precautionary Labels for Gas Cylinders
ISO 7866-2012	Refillable seamless aluminium alloy cylinders – Design, construction and testing
ISO 9001:2015	Quality Assurance in Design/Development. Production, Installation and Servicing
ISO/TS 9002:2016	Quality management systems - Guidelines for the application of ISO 9001:2015
ISO12991:2012	Liquefied natural gas (LNG) – transportable tanks for use on board of vehicles
ISO14469:2017	Road Vehicles: compressed natural gas CNG refuelling connector
ISO15500-2:2016	Road vehicles – Compressed natural gas (CNG) fuel system components Part 2: Performance and general test methods
ISO 15500-17:2012	Road vehicles - Compressed natural gas (CNG) fuel system components - Part 17: Flexible fuel line
ISO 21028-1:2016	Cryogenic vessels – Toughness requirements for materials at cryogenic temperature – Part I: Temperatures below -80 °C
ISO 21029-1:2015	Cryogenic vessels – Transportable vacuum insulated vessels of not more than 1,000 litres volume – Part I: Design, fabrication, inspection and tests
ISO/IEC 17025:2005	General requirements for the competence of testing and calibration laboratories
ISO 9809-1:2010	Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 1: Quenched and tempered steel cylinders with tensile strength less than 1,100 MPa

ISO 11439:2013	Gas cylinders — High pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles
NACE Standard[5]	
NACE TM0177-90	Laboratory Testing of Metals for Resistance to Sulphide Stress Cracking in H_2S Environments
UN Regulations[6]	
UN Regulation No. 10	Uniform provisions concerning the approval of vehicles with regard to electromagnetic compatibility
USA Federal Regulations[7]	
49 CFR 393.67	Liquid fuel tanks (as amended in 78 FR 58484 on 24 September 2013)
SAE Standards[8]	
SAE J2343-2008	Recommended Practice for LNG Medium and Heavy-Duty Powered Vehicles"

Insert new paragraphs 24.15. to 24.21., to read:

"24.15. As from the official date of entry into force of the 03 series of amendments, no Contracting Party applying this Regulation shall refuse to grant or refuse to accept UN type-approvals under this Regulation as amended by the 03 series of amendments.

24.16. As from 1 September 2019, Contracting Parties applying this Regulation shall not be obliged to accept UN type-approvals of components approved to the requirements of Part I of this Regulation to the 02 series of amendments, first issued after 1 September 2019.

24.17. As from 1 September 2021, Contracting Parties applying this Regulation shall not be obliged to accept UN type-approvals of vehicles approved to the requirements of Part II of this Regulation to the 02 series of amendments, first issued after 1 September2021.

24.18. Contracting Parties applying this Regulation shall continue to accept UN type-approvals issued according to the 02 series of amendments to this Regulation first issued before 1 September 2019 in the case of components approved to the requirements of Part I of this Regulation, and before 1 September 2021 in the case of vehicles approved to the requirements of Part II of this Regulation.

24.19. Contracting Parties applying this Regulation shall not refuse to grant UN type-approvals according to any preceding series of amendments to this Regulation or extensions thereof.

24.20. Contracting Parties applying this Regulation shall continue to accept UN type-approvals of, and to grant extensions of approvals to the equipment and

[5] National Association of Corrosion Engineers.
[6] United Nations Economic Commission for Europe; Regulations.
[7] United States of America Federal Regulations.
[8] Society of Automotive Engineers.

part to the preceding series of amendments to this Regulation which are not affected by the changes introduced by the 03 series of amendments.

24.21. Contracting Parties applying this Regulation shall continue to accept UN type-approvals to the 02 series of amendments to this Regulation, first issued before 1 September 2021."

Annex 3A

Table 6.4, replace the entry "Acid environment test" by "Environmental test".

Paragraph 6.3.6., amend to read:

"6.3.6. Plastic liners

The tensile yield strength and ultimate elongation shall be determined in accordance with paragraph A.22. (Appendix A to this annex). Tests shall demonstrate the ductile properties of the plastic liner material at temperatures of -50 °C or lower by meeting the values specified by the manufacturer; the polymeric material shall be compatible with the service conditions specified in paragraph 4. of this annex. In accordance with the method described in paragraph A.23. (Appendix A to this annex), the softening temperature shall be at least 100 °C."

Paragraph 6.12., amend to read:

"6.12. Exterior environmental protection

The exterior of cylinders shall meet the requirements of the environmental test conditions of paragraph A.14. (Appendix A to this annex). Exterior protection shall be provided by using any of the following:

(a) A surface finish giving adequate protection (e.g. metal sprayed on aluminium, anodizing); or

(b) The use of a suitable fibre and matrix material (e.g. carbon fibre in resin); or

(c) A protective coating (e.g. organic coating, paint) that shall meet the requirements of paragraph A.9. (Appendix A to this annex).

Any coatings applied to cylinders shall be such that the application process does not adversely affect the mechanical properties of the cylinder. The coating shall be designed to facilitate subsequent in service inspection and the manufacturer shall provide guidance on coating treatment during such inspection to ensure the continued integrity of the cylinder."

Paragraph 8.6.4., amend to read:

"8.6.4. Environment test

One cylinder shall be tested in accordance with paragraph A.14. (Appendix A to this annex) and meet the requirements therein."

Annex 3A, Appendix A

Paragraph A.14., amend to read (inserting new sub-paragraphs A.14.1. to A14.6., based mainly on the text of Annex 3A, Appendix H):

"A.14. Environmental test

A.14.1. Scope

This test is applicable to type CNG-2, CNG-3 and CNG-4 designs only.

A.14.2. Cylinder set-up and preparation

The upper section of the cylinder will be divided into 5 distinct areas and marked for preconditioning and fluid exposure (see Figure A.1). The areas will be nominally 100 mm in diameter. The areas shall not overlap on the cylinder surface. While convenient for testing, the areas need not be oriented along a single line, but shall not overlap the immersed section of the cylinder.

Although preconditioning and fluid exposure is performed on the cylindrical section of the cylinder, all of the cylinder, including the domed sections, should be as resistant to the exposure environments as are the exposed areas.

Figure A.1
Cylinder orientation and layout of exposure areas

A.14.3. Pendulum impact preconditioning

The impact body shall be of steel and have the shape of a pyramid with equilateral triangle faces and a square base, the summit and the edges being rounded to a radius of 3 mm. The centre of percussion of the pendulum shall coincide with the centre of gravity of the pyramid; its distance from the axis of rotation of the pendulum shall be 1 m. The total mass of the pendulum referred to its centre of percussion shall be 15 kg. The energy of the pendulum at the moment of impact shall be not less than 30 Nm and as close to that value as possible.

During pendulum impact, the cylinder shall be held in position by the end bosses or by the intended mounting brackets. The cylinder shall be un-pressurized during preconditioning.

A.14.4. Environmental fluids for exposure

Each marked area is to be exposed to one of five solutions for 30 minutes. The same environment shall be used for each location throughout the test. The solutions are:

Sulphuric acid:	19 per cent solution by volume in water;
Sodium hydroxide:	25 per cent solution by weight in water;
5% Methanol/95% gasoline:	gasoline concentration of M5 fuel meeting the requirements of ASTM D4814;
Ammonium nitrate:	28 per cent by weight in water;
Windshield washer fluid	50 per cent by volume solution of methyl alcohol and water.

When exposed, the test sample will be oriented with the exposure area uppermost. A pad of glass wool (approximately 0.5 mm thick and between 90 and 100 mm in diameter) shall be placed on the exposure area. Apply an amount of the test fluid to the glass wool sufficient to ensure that the pad is wetted evenly across its surface and through its thickness for the duration of

the test, and that the concentration of the fluid is not changed significantly during the duration of the test.

A.14.5. Pressure cycle and hold

The cylinder shall be hydraulically pressure cycled between not more than 2 MPa and not less than 26 MPa for a total of 3,000 cycles. The maximum pressurization rate shall be 2.75 MPa per second. After pressure cycling, the cylinder shall be pressurized to 26 MPa and held at that pressure a minimum of 24 hours and until the elapsed exposure time (pressure cycling and pressure hold) to the environmental fluids equals 48 hours.

A.14.6. Acceptable results

The cylinder shall be hydraulically tested to destruction in accordance with the procedure in paragraph A.12. The burst pressure of the cylinder shall be not less than 85 per cent of the minimum design burst pressure."

Through the whole text of the Regulation, replace the references to "acid environmental test" by "environment test" and delete the references to Annex 3A, Appendix H.

Paragraph A.16., amend to read:

"A.16. Penetration tests

A cylinder pressurised to 20 MPa ± 1 MPa with compressed gas shall be penetrated by an armour piercing bullet with a diameter of 7.62 mm or greater. The bullet shall completely penetrate at least one side wall of the cylinder. For type CNG-1 designs, the projectile shall impact the side wall at 90°. For type CNG-2, CNG-3 and CNG-4 designs, the projectile shall impact the side wall at an approximate angle of 45°. The cylinder shall reveal no evidence of fragmentation failure. Loss of small pieces of material, each not weighing more than 45 grams, shall not constitute failure of the test. The approximate size of entrance and exit openings and their locations shall be recorded."

Paragraph A.22., amend to read:

"A.22. Tensile properties of plastics

The tensile yield strength and ultimate elongation of plastic liner material shall be determined at -50 °C using ISO 527-2, and meet the requirements of paragraph 6.3.6. of Annex 3A."

Paragraph A.23., amend to read:

"A 23. Softening temperature of plastics

Polymeric materials from finished liners shall be tested in accordance with the method described in ISO 306. The softening temperature shall be at least 100 °C."

Annex 3A, Appendix F, paragraph F.2.1., subparagraph (c), amend to read:

"(c) Fracture toughness of the finished cylinder or the liner from a finished cylinder, as determined at room temperature for aluminium and at -40 °C for steel, shall be established using a standardized testing technique (either ASTM 813-89 or BS 7448) in accordance with Sections 8.4 and 8.5 of BS PD6493"

Annex 3A, Appendix H, shall be deleted.

Annex 4F, paragraph 2.2., amend to read:

"2.2. CNG filling units designed in accordance with ISO 14469 and meeting all the requirements therein are deemed to fulfill the requirements of paragraphs 3. and 4. of this annex."

Annex 4J, paragraph 3.1.5., amend to read:

"3.1.5. The LNG filling receptacle shall be made out of non-sparking material and should comply with the no igniting evaluation tests described in ISO 14469."